Remarks at the

Twenty-fifth Anniversary of the
Guggenheim School of Aeronautics
New York University
University Heights, New York

January 26, 1950

by Hugh L. Dryden, Director
National Advisory Committee for Aeronautics

May I extend my personal congratulations on the occasion of the Twenty-fifth Anniversary of the founding of the Daniel Guggenheim School of Aeronautics. I know of no better return on any investment than that which resulted from Mr. Guggenheim's generosity. The stimulation of aeronautical education and research had an influence throughout the whole nation in markedly accelerating aeronautical development.

Dean Saville suggested that I say a few words on the subject "Aerodynamics Research of the Future". But before discussing this subject, I wish to express my deep appreciation to New York University for the high honor conferred upon me today. It is an honor that I accept as symbolic of successful teamwork with associates no less worthy of such recognition. For teamwork is essentially the key to real productiveness in science today. On this twenty-fifth anniversary of the founding of the Daniel Guggenheim School of Aeronautics, we can sense a change in the prerequisites for scientific accomplishment over that still prevailing a short quarter century ago. The outstanding solo worker is now a rare bird indeed. Outstanding teams are many. My own scientific work was the product of a research group at the

National Bureau of Standards, with which my name was associated for nearly thirty years. It is but a coincidence that I am now Director of the National Advisory Committee for Aeronautics, the government research organization that sponsored, and still does sponsor, a continuation of that research work at the Bureau.

Now I am but an occasional scientist, and most often an administrator. Much of my job is missionary in character--spreading the knowledge of the enormity of the research task facing us in our pursuit of air leadership so essential to our security.

For just a minute or two, let us consider an example of what answers are expected of the aeronautical scientist and how he must be supported with equipment to supply those answers.

By severely compromising practicability for operational uses and by availing ourselves of the services of a succession of determined pilots, led off by the Air Force's Captain Charles E. Yeager, research airplanes have been flown at speeds well in excess of that of sound. We may expect a succession of further penetrations into the supersonic speed regimes with each passing month. These flights represent great achievement and reflect enormous credit on all involved--the military, the manufacturers, and the scientists. To the designer of operational-type aircraft, however, they simply represent goals--somewhat distant ones at that, depending upon the rapidity with which he can secure detailed design information. It is not simple, but certainly it is relatively simple to contrive a machine merely to go fast. But practical operational speed is the most important attribute of an airplane. What makes the airplane design game worthwhile are the beautifully balanced compromises that give the craft an ability to take off and land safely, to have a useful range, to carry a useful load, to operate at desired altitudes, to maneuver for its intended purposes, to withstand the air loads imposed upon it--in short, to do everything we want it to do as well as to go fast.

It is in this area of necessary design compromise that research that yields detail design information pays off. It is an unglamorous, time-consuming, and costly type of research. In the high speed regimes it is many times more costly than in the subsonic speed range. Moreover, as the designer is in competition for military contracts, his understandable pressing for new data knocks the traditional atmosphere of leisurely contemplation of the scientist into a cocked hat. Ulcers are as common in the modern aeronautical research business as in the advertising business.

Looking at today's picture in terms of rough numbers, operational type military aircraft are flying fairly generally in the transonic speed regime--with occasional difficulties as anticipated. These difficulties require early solutions. The swept wing, which delays the onset of compressibility, offers a large share of the solution. Just coming into operation are large-scale wind tunnels capable of speeds up to a Mach number of 2, or twice the speed of sound. These large tunnels were planned three to five years ago and represent a mere beginning of needed wind tunnel construction, in order that detail design information can be supplied aircraft designers. In the meantime, small tunnels with Mach numbers ranging up to Mach 10, are cropping up here and there as the fundamental scientists push ever forward in laying the groundwork for still higher speeds for experimental aircraft and missiles. Where does this thing end? This question has repeatedly been asked for many years. It was asked by an economy-minded Congressman back in the 1920's when the NACA asked for funds to construct a large-scale wind tunnel with speeds up to 120 miles per hour. If we were to rest content with any given achievement of speed, we would thereby concede to some other more realistic and forward-looking nation, the control of the air that is essential to our national security.

In going from subsonic to supersonic flight, the aerodynamic research picture is immensely complicated by the changes in the behavior of the medium. The condition of mixed flow in the transonic range poses unsolved problems of mathematics to establish reliable theory. As yet we have no wind tunnels in operation which are capable of supplying reliable experimental data in the transonic regime.

In the subsonic wind tunnel, we could vary the tunnel speed simply by changing the speed of the blower. In the supersonic tunnel, we must change the shape of the tunnel to vary the speed. Moreover, the power requirements are enormous to operate large scale supersonic tunnels. The eight- by six-foot wind tunnel at our Lewis Laboratory in Cleveland is powered by three motors totaling 87,000 horsepower. In addition, there is a 5,000-horsepower motor for driving auxiliary equipment. By contrast, only 8,000 horsepower were required to drive our 8-foot tunnel at Langley up to speeds of 500 miles per hour.

There was never a serious question as to the need for wind tunnels for research leading to the design of subsonic aircraft. For supersonic aircraft design, the need is even more obvious. Such airplanes will be enormously expensive. No manufacturer can afford to go into the supersonic airplane development business and risk a failure. The stakes are high, and the designer must have reliable detail design information to assure success in meeting military specifications. The situation might be relieved if individual components could be studied piecemeal. But the interaction of components is of critical importance. Where should intakes be located? What is the effect of jet flow? What about wing-fuselage interference? The designer must know the answers. Facilities permitting detailed study of complete models at satisfactorily large scale seem to offer the only means of supplying these answers systematically and economically.

One of the important research goals is the conversion of research airplane speed achievements to everyday performance for operational-type aircraft. The problems involved challenge the best trained minds of our day. The stakes are not only high for the individual aircraft designer; they are high for all of us, for in continued success in this field at the hands of free men, lies, partly, at least, our hope of peace.

# # # #